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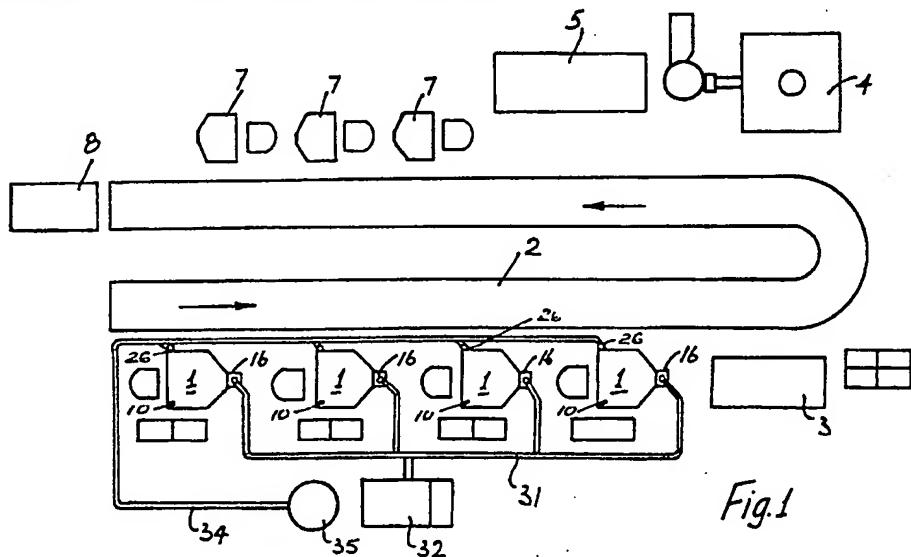
57-60 Lincoln's Inn Fields, LONDON, WC2A 3LS,  
United Kingdom

## (54) Renovating process-cartridge for an electrostatographic machine.

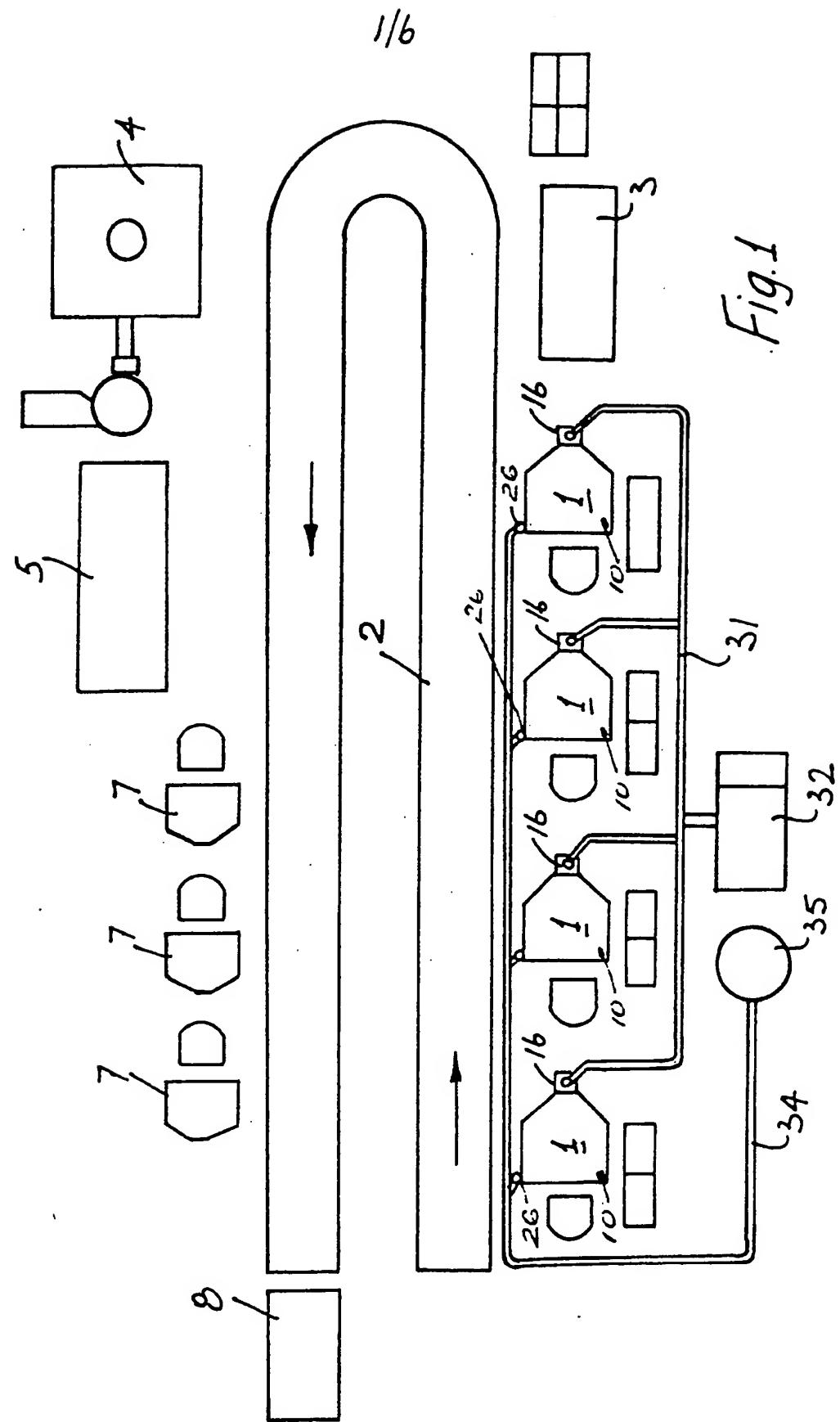
(57) A process kit for a laser printer is refurbished by:

- (a) Dismantling the parts,
- (b) Cleaning (using high pressure air and vacuum),
- (c) Testing the printing performance of the photoreceptor,
- (d) Refilling the toner hopper with a measured amount of toner,
- (e) Resurfacing the magnetic toner applicator roller by coating,
- (f) Reassembling the parts to form a reconditioned cartridge (including re-sealing against loss of toner during shipping).

A booth for the cleaning step, arrangements for metering fresh toner, and a jig for re-sealing the reconditioned cartridge are all described with reference to respective figures. A production line (comprising respective work stations along a conveyor) is also described.



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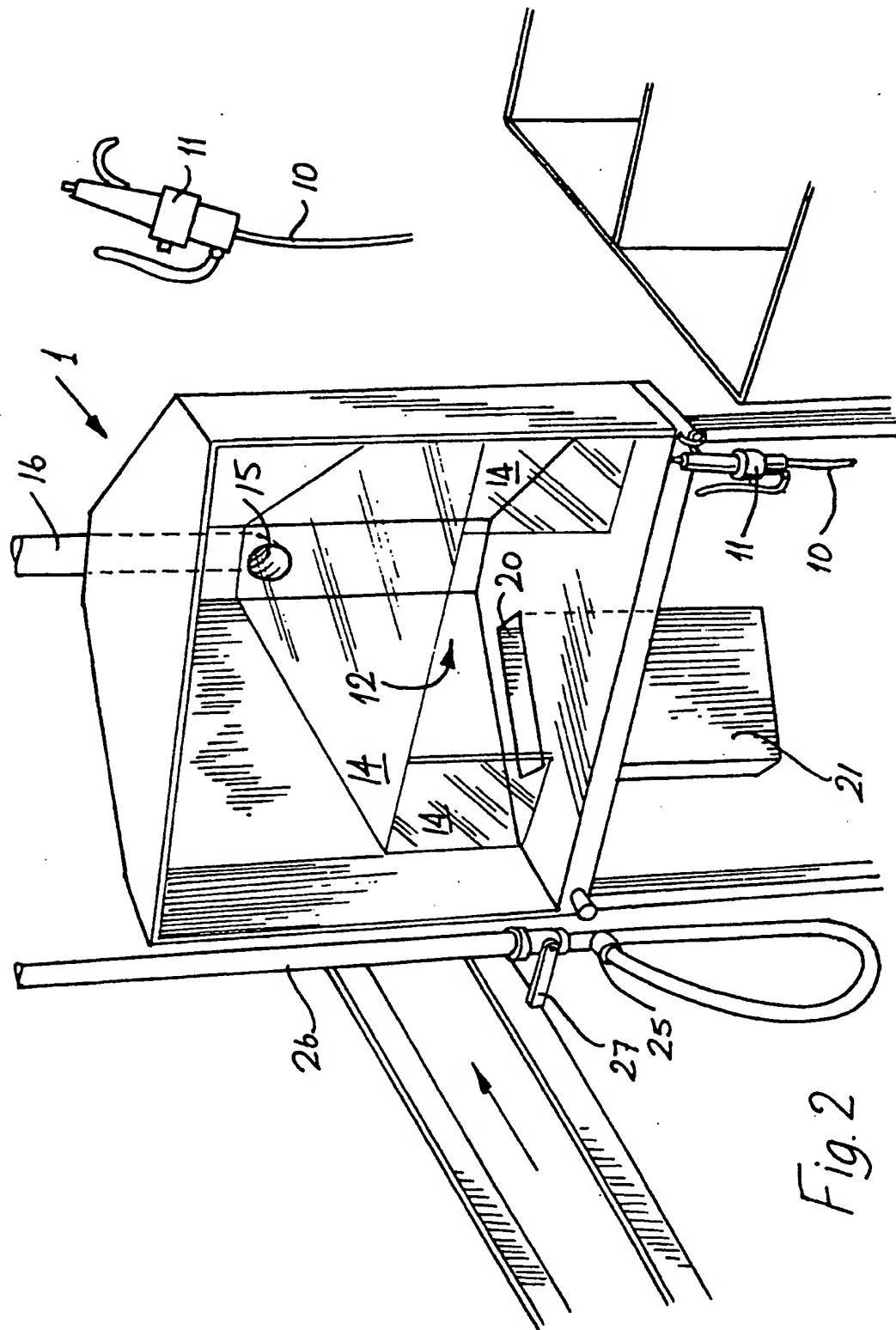


Fig. 2

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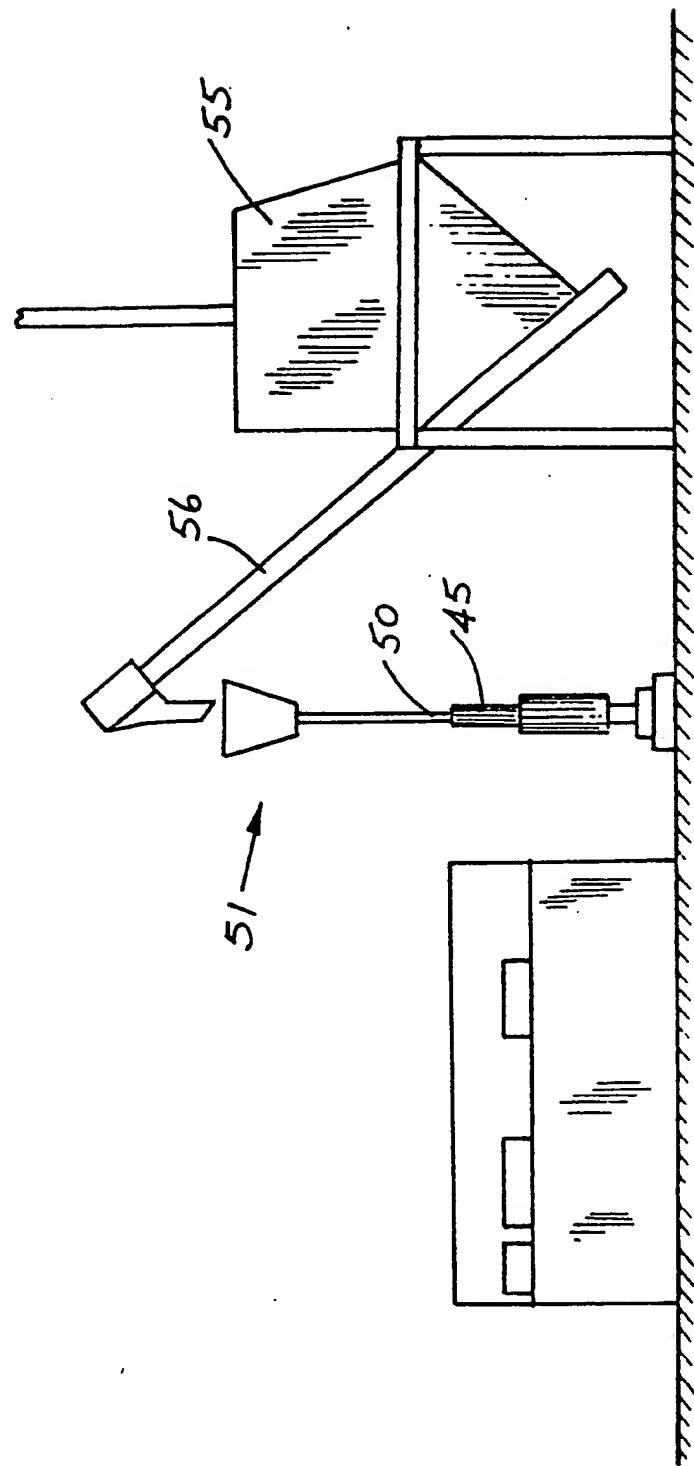


Fig. 3

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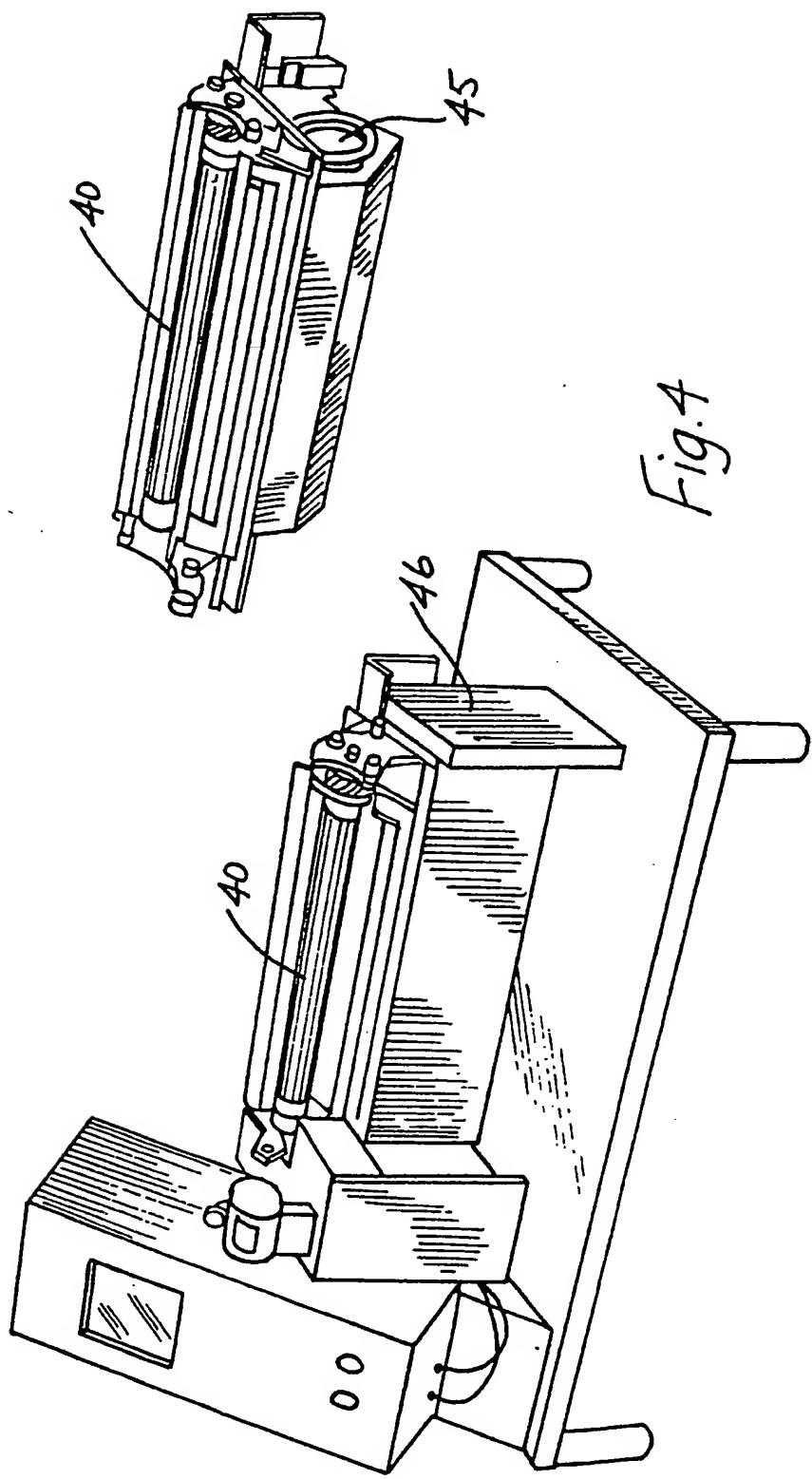
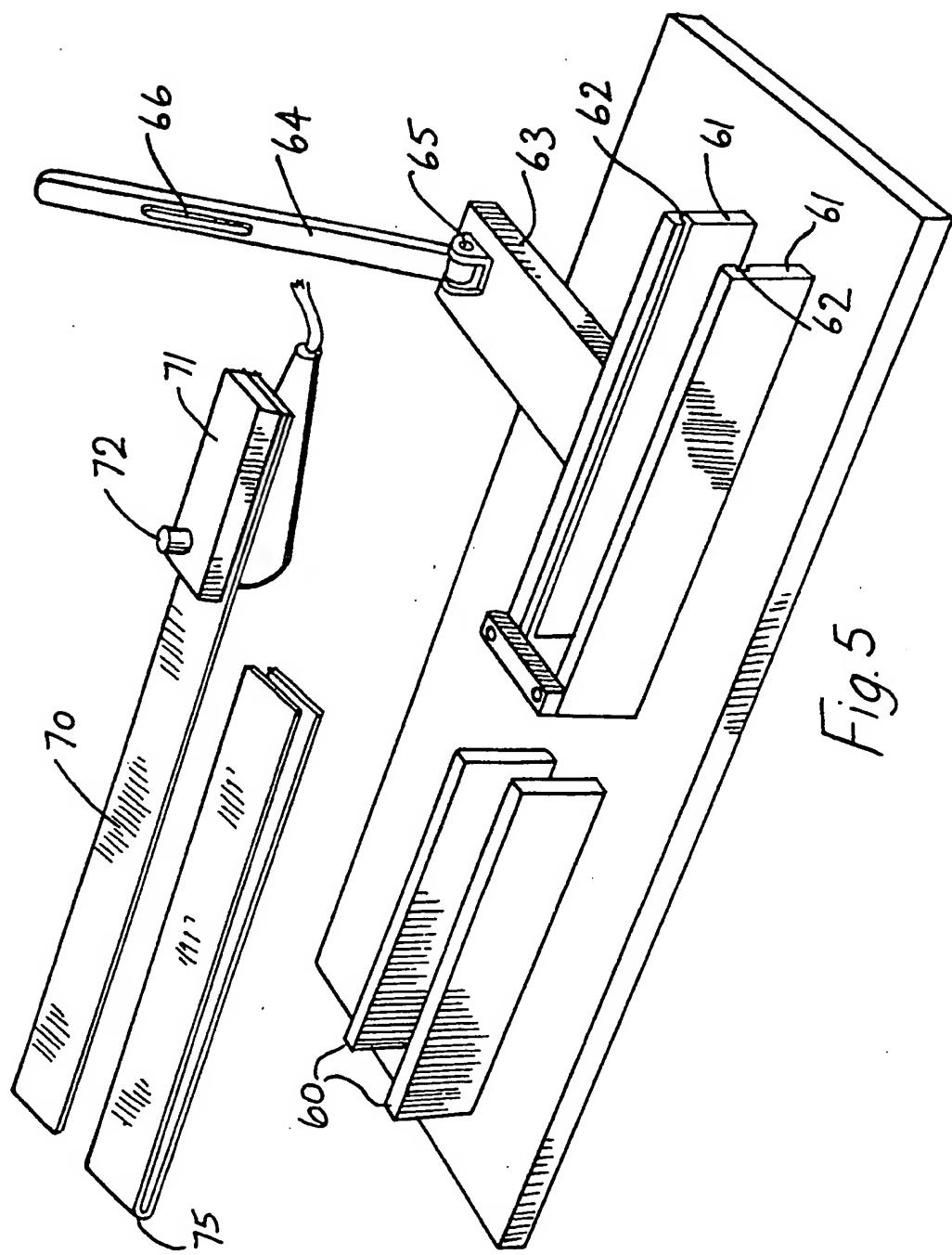
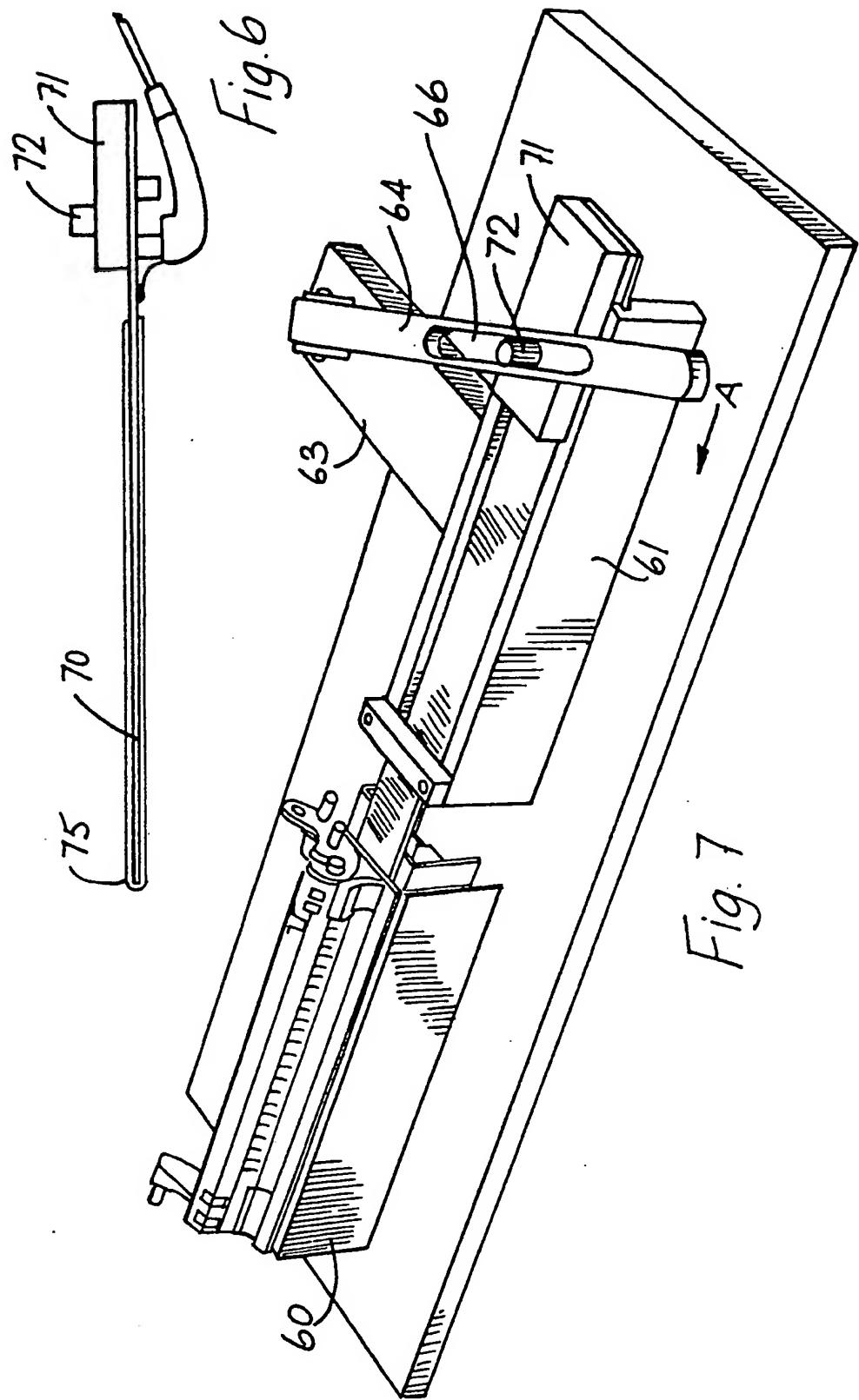


Fig.4

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"A method for manufacturing a printer cartridge"

The invention relates to a method for manufacturing a printer cartridge and in particular for remanufacturing a printer cartridge for a laser printer.

5 According to the invention there is provided a method for remanufacturing a printer cartridge for a laser printer comprising the steps of:-

disassembling a used cartridge;

10 during disassembly, cleaning the parts of the cartridge in a cleaning booth having a pressure air inlet, a vacuum inlet and an air outlet;

15 delivering pressure air into the cartridge parts from the pressure air inlet to dislodge dirt and toner particles;

simultaneously extracting the removed dirt and toner particles from the cleaning booth through the air outlet;

20 applying a vacuum to a toner reservoir of the cartridge through the vacuum inlet to remove residual toner in the reservoir;

arranging all the parts of the laser printer cartridge on a tray;

25 conveying the tray along a conveyor to a photoconductor roller testing station;

- inserting the photoconductor roller to be tested into a laser printer;
- 5 testing the quality of the print outputted from the laser printer containing the photoconductor roller under test and categorising the roller accordingly;
- conveying the tray along the conveyor to a toner filling and magnetic roller coating station;
- 10 delivering toner from a supply reservoir to a filling head of a filling machine;
- inserting the toner reservoir under the filling head;
- 15 filling a predetermined quantity of toner into the reservoir;
- mounting a magnetic roller part of the laser printer cartridge for rotation;
- rotating the magnetic roller while applying coating material;
- 20 drying the coating material;
- reassembling the toner reservoir to the cartridge adjacent the coated magnetic roller;
- 25 cleaning the region between the toner reservoir and the magnetic roller;

sealing the toner reservoir;

delivering the tray along the conveyor to a reassembly station; and

reassembling the laser printer cartridge.

5 In a particularly preferred embodiment of the invention the photoconductor roller is inserted sequentially in at least two laser printers with different test programmes to categorise the photoconductor roller as suitable for a graphics or text application.

10 In a preferred embodiment to the invention the pressure air of the cleaning booth is arranged towards the rear and top of the booth to direct all dirt and toner particles removed from the cartridge parts through the air outlet.

15 Advantageously the air outlet of the cleaning booth is arranged towards the rear and top of the booth to direct all dirt and toner particles removed from the cartridge parts through the air outlet.

20 In a preferred embodiment to the invention there are a plurality of disassembly booths adjacent the conveyor, the booths being provided with pressure air, vacuum supply and air extraction from common supplies.

25 In a particularly preferred embodiment to the invention the region between the toner reservoir and the magnetic roller is cleaned by folding a cleaning strip around an elongate blade, and inserting the blade with the cleaning

strip in position between the toner reservoir and magnetic roller.

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Advantageously the toner reservoir is sealed by folding a sealing strip around a blade, inserting the blade with the sealing strip in position between the toner reservoir and magnetic roller, and heat sealing the sealing strip into position.

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In a particularly preferred embodiment to the invention the auxiliary pushing means are provided for inserting the blade into position during cleaning and sealing.

Advantageously the auxiliary pushing means comprises a lever which is attached to the blade and pushed forward to insert the blade into position between the toner reservoir and magnetic roller.

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The invention will be more clearly understood from the following description thereof given by way of example only with reference to the accompanying drawings in which:-

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Fig. 1 is a plan view illustrating a method for remanufacturing a laser printer cartridge in accordance with the invention;

Fig. 2 is a perspective view of a cleaning booth used in the method of the invention;

Fig. 3 is a side elevational view of a toner reservoir filling step in the method of the invention;

Fig. 4 is a perspective view of an apparatus used in a magnetic roller coating step of the invention;

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Fig. 5 is a exploded perspective view of an apparatus used in a cleaning and sealing step of the invention; and

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Figs. 6 and 7 are respectively side elevational and perspective views of the apparatus of Fig. 5 in use. Referring to the drawings in a method for remanufacturing a printer cartridge for a laser printer according to the invention a used printer cartridge is first disassembled in one of a plurality, in this case four booths 1. The disassembled parts are placed on individual trays and carried by conveyor to a photoconductor roller testing station 3. The tray of cartridge parts then travels along the conveyor through to a toner filling station 4 and a station 5 at which the magnetic rollers are coated toner, the reservoir is reassembled to the magnetic roller, cleaned and sealed. Finally, the tray passes along the conveyor 2 to one of a plurality of reassembly stations 7 at which the cartridge parts are reassembled prior to packaging at a packaging station 8.

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In more detail and referring to Fig. 2 a cleaning booth 1 used in the method of the invention as illustrated. The booth 1 includes a pressure air inlet 10 which is operated by a trigger mechanism 11 to deliver air on demand for cleaning the parts of the laser printer cartridge during disassembly in the booth 1. The booth 1 includes a working area 12 in which the cleaning of the parts takes place and which is partially covered by transparent, for example, perspex sheeting 14. At the top and towards the rear of the working area 12 an air outlet 15 is provided through which pressure air containing dirt and toner

5 particles removed during the cleaning process is extracted to an extractor duct 16. Bulk waste material from the cartridge is delivered through an outlet slot 20 in the working area 12 into a bin 21. A vacuum inlet 25 is provided for removing residual toner from a toner reservoir of the laser printer cartridge. A vacuum is supplied to the inlet 25 along an inlet vacuum line 26 fitted with a valve 27.

10 Pressure air to the cleaning booths 1 is provided from a common header (not shown). Similarly the air outlets 16 are collected in a common air outlet header 31 for delivery of the air through an air filter bank 32. Vacuum is supplied from a common vacuum header 34 to a suction unit 35.

15 During disassembly of the laser printer cartridge, the parts of the cartridge are thoroughly cleaned in the booth by delivering pressure air through the line 10 onto the cartridge parts to dislodge dirt and toner particles. Simultaneously the dirt and toner particles are extracted through the outlet 15. A vacuum is applied to the toner reservoir of the cartridge from the vacuum inlet 25 to remove residual toner in the reservoir.

20  
25 All of the cleaned parts of the laser printer cartridge are then arranged on a tray which is placed on the conveyor 2 and delivered to the photoconductor roller testing station 3. At the testing station 3 the photoconductor roller to be tested is inserted sequentially into a number of different laser printers which are programmed with different test printing programmes. The output from the laser printers on test of the photoconductor roller allows the roller to be categorised as either reject, suitable for graphics

applications or suitable for text applications. The laser printer cartridge is categorised accordingly.

A magnetic roller 40 and toner reservoir 41 together with associated mountings are removed at station 5. The magnetic roller 40 is rotatably mounted on a mounting block 46 as illustrated in Fig. 4. The roller 40 is then rotated and during rotation of the roller 40 a liquid coating material is applied over the outer surface of the roller 40. The roller and associated mountings are removed from the plinth 46 and the coated material is allowed to dry. The toner reservoir 45 is placed under the filling head 50 of a filling machine 52 which is illustrated in Fig 3. A feed hopper 52 of the filling machine 51 is provided with a required quantity of toner from a hopper 55 via a screw conveyor 56. The toner reservoir 45 is placed under the filing head 50 and a predetermined quantity of toner is delivered into the reservoir to recharge it.

To seal the toner reservoir 45 the reservoir and associated mountings are first mounted on a support provided by two spaced-apart support plates 60 as illustrated in Figs. 5 to 7. A pair of auxiliary plates 61 are mounted in parallel with support plates 60 each of which is provided with elongate guide or alignment slots 62. A bracket 63 extends transversely of one of the plates 61 and a lever 64 is pivotally mounted at a lower end 65 to the bracket 63. The lever 64 also includes an elongate slot 66. A cleaning and sealing elongate blade 70 is provided with a block 71 having an upstanding peg 72 which is engagable in the slot 66 of the lever 64 as will be described in more detail below. The blade 70 is inserted through the elongate slots 62 towards the supports 60.

The area between the toner reservoir 45 and magnetic roller 40 is first cleaned by wrapping a cleaning strip 75 around the blade 70 and then inserting the blade 70 with a cleaning strip 75 in position through the slot 62 towards the supports 60 to clean the exposed edges of the toner reservoir. To ensure complete cleaning and that the blade 70 has been fully inserted after a preliminary manual insertion the lever 66 is dropped down over the blade so that the peg 72 engages in the slot 66. The lever 64 is then pushed forwardly in the direction of the arrow A in Fig 7 to fully insert the blade 70. This process is reversed for removal of the blade. After cleaning, the cleaning strip 75 is removed and disposed of. A sealing strip is then wrapped around the blade 70 and the blade with the sealing strip in position is again inserted. When the sealing strip is in position power is applied to the blade 70 to heat seal the strip in the desired sealing position. The magnetic roller and toner reservoir combination is then removed from the support and replaced in the mounting tray for delivery along the conveyor through to one of the reassembly stations 7. At each reassembly station 7 the various parts of the laser printer cartridge are reassembled prior to packaging.

The invention provides an integrated, highly efficient process for remanufacturing laser printer cartridges.

The invention is not limited to the embodiments hereinbefore described but may vary both in construction and detail.

CLAIMS

1. A method for remanufacturing a printer cartridge for a laser printer comprising the steps of:-

disassembling a used cartridge;

5 during disassembly, cleaning the parts of the cartridge in a cleaning booth having a pressure air inlet, a vacuum inlet and an air outlet;

10 delivering pressure air into the cartridge parts from the pressure air inlet to dislodge dirt and toner particles;

simultaneously extracting the removed dirt and toner particles from the cleaning booth through the air outlet;

15 applying a vacuum to a toner reservoir of the cartridge through the vacuum inlet to remove residual toner in the reservoir;

arranging all the parts of the laser printer cartridge on a tray;

20 conveying the tray along a conveyor to a photoconductor roller testing station;

inserting the photoconductor roller to be tested into a laser printer;

25 testing the quality of the print outputted from the laser printer containing the

- photoconductor roller under test and categorising the roller accordingly;
- conveying the tray along the conveyor to a toner filling and magnetic roller coating station;
- 5  
delivering toner from a supply reservoir to a filling head of a filling machine;
- inserting the toner reservoir under the filling head;
- 10  
filling a predetermined quantity of toner into the reservoir;
- mounting a magnetic roller part of the laser printer cartridge for rotation;
- 15  
rotating the magnetic roller while applying coating material;
- drying the coating material;
- reassembling the toner reservoir to the cartridge adjacent the coated magnetic roller;
- 20  
cleaning the region between the toner reservoir and the magnetic roller;
- sealing the toner reservoir;
- delivering the tray along the conveyor to a reassembly station; and

reassembling the laser printer cartridge.

2. A method as claimed in claim 1 wherein the photoconductor roller is inserted sequentially in at least two laser printers with different test programmes to categorise the photoconductor roller as suitable for a graphics or text application.  
5
3. A method as claimed in claim 1 or 2 wherein the pressure air for cleaning is applied through a trigger operated air inlet for cleaning the cartridge parts on demand.  
10
4. A method as claimed in any preceding claim wherein the air outlet of the cleaning booth is arranged towards the rear and top of the booth to direct all dirt and toner particles removed from the cartridge parts through the air outlet.  
15
5. A method as claimed in any preceding claim wherein there are a plurality of disassembly booths adjacent the conveyor, the booths being provided with pressure air, vacuum supply and air extraction from common supplies.  
20
6. A method as claimed in any preceding claim wherein the region between the toner reservoir and the magnetic roller is cleaned by folding a cleaning strip around an elongate blade, and inserting the blade with the cleaning strip in position between the toner reservoir and magnetic roller.  
25
7. A method as claimed in any preceding claim wherein the toner reservoir is sealed by folding a sealing strip around a blade, inserting the blade with the

sealing strip in position between the toner reservoir and magnetic roller, and heat sealing the sealing strip into position.

8. A method as claimed in claim 6 or 7 wherein auxiliary pushing means are provided for inserting the blade into position during cleaning and sealing.
- 5
9. A method as claimed in claim 8 wherein the auxiliary pushing means comprises a lever which is attached to the blade and pushed forward to insert the blade into position between the toner reservoir and magnetic roller.
- 10
10. A method for re-manufacturing a printer cartridge for a laser printer substantially as hereinbefore described with reference to the accompanying drawings.
- 15
11. A laser printer cartridge whenever re-manufactured by a method as claimed in any preceding claim.

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**Patents Act 1977**  
**Examiner's report to the Comptroller under Section 17**  
**(The Search report)**

Application number  
**GB 9407704.7**

**Relevant Technical Fields**

- (i) UK Cl (Ed.M)      B6C: CBX, CCA  
 (ii) Int Cl (Ed.5)      G03G-015/08; -021/00

Search Examiner  
**F G MILES**

Date of completion of Search  
**8 SEPTEMBER 1994**

**Databases (see below)**

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

Documents considered relevant following a search in respect of Claims :-  
 1

(ii) ONLINE DATABASES: WPI

**Categories of documents**

- |    |   |    |   |
|----|---|----|---|
| X: | Document indicating lack of novelty or of inventive step.   | P: | Document published on or after the declared priority date but before the filing date of the present application.        |
| Y: | Document indicating lack of inventive step if combined with one or more other documents of the same category. | E: | Patent document published on or after, but with priority date earlier than, the filing date of the present application. |
| A: | Document indicating technological background and/or state of the art.   | &: | Member of the same patent family; corresponding document.   |

Category	Identity of document and relevant passages		Relevant to claim(s)
A	US 5258814 A	(DAVIES)	1
A	US 5289233 A	(SAKAMOTO)	1

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